ESTIMATION OF 305-DAY YIELD FROM TOTAL MILK YIELDS IN BUNAJI AND FRIESIAN-BUNAJI CROSSES

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ABSTRACT

Lactation data of 207 cows comprising of 91 Bunaji and 116 Friesian-Bunaji crosses milking for over 305 days were analysed on the basis of average daily yield (ADY), actual 305-day yield (A305), total yield (TY) and lactation length (LL). The objective was to fit a suitable equation that would estimate 305-day yield from TY and to develop estimation factors. The linear regression equations for estimating 305-day yield from TY are Y = 1895.229 + 0.804 TY (R^2 = 0.971) and Y = 366.176 + 0.775 TY (R^2 = 0.827) for Bunaji and Friesian-Bunaji cows respectively. Various combinations of TY, ADY and LL were used in multiple regressions to estimate 305-day yield with R^2 values of over 90%. Factors for the estimation of 305-day yield from cows lactating for periods between 305 to 350 days were developed from the fitted equations.

Key words: Total milk yield; 305-day yield; Regression equations; Multiplicative factors; Bunaji; Friesian-Bunaji crosses.

INTRODUCTION

Milk secretion commences in cows shortly after calving. Sixty days preceding parturition, it is conventional to dry the cow. Since there are 365 days in a year, it means there are 305 days within which a cow xould be milked if the desire is for her todrop one claf per year. Thus 305-day milk yield is taken as a standard for making meaningful comparisons between and within breeds of cows in different environments all over the world.

It is known however, that whle some cows yield milk for well over 305 days (Stanton *et al*, 1988), others do not lactate up to 305 days. In the latter case, the use of extension factors on such partial lactations to estimate 305-day yield is widely practised as evidenced by the work of several researchers (Fritz *et al*, 1960; Van Vleck and Henderson, 1961; Schaeffer *et al*, 1976; Do *et al*, 1986; Khoda and Trivedi, 1987; Shrivastava and Khan, 1989).

In tropical cattle only very few lactations go beyond 305 days. When analysing data, a possible option is to throw these records out. However, in situations with limited data pool, it is better to maximize the utilization of all records. On most government farms in Nigeria especially the Livestock investigation and Breeding Centres (LIBC's), the daily/weekly milk records and total lactation records are kept in separate books. It is usually difficult to obtain 305-day yields because the daily/weekly records are often missing while it is easier to locate records on total yields. The present study was initiated to address such a specific practical problem.

The objective of this study therefore was tof it suitable regression equations that would estimate 305-day yield from total milk yield, and also to develop estimation factors.

MATERIALS AND METHODS

The lactation data analysed originated from the milking herd of the National Animal Production Research Institute (NAPRI) Shika, Nigeria, located between latitudes 11° and 12°N at an altitude of 640m above sea level. Mean annual rainfall in thisnorthern guinea savannah zone is 1.100m which commences from May and lasts till October, of which 90% falls during the wet or rainy season (June - September). Following the wet season is a period of dry, cool weather called 'harmattan' which marks the onset of the dry season. This extends from mid-October to January. The dry season (February to May) is characterized by very hot weather conditions. At this period, daily temperatures range from 21°C to 36°C. The mean releative humidity are 21 and 72% during 'harmattan' and the rainy season respectively.

Of all the local breeds of cattle in Nigeria, the Bunaji (or White Fulani) is the most widespread and extensively studied. It was first introduced to Shika in 1928 and for many years, it constituted the entire milking herd, until 1964 when crossbreeding with Friesians commenced.

The animals were raised during the rainy season on paddock-sown pastures, while hay or silage supplemented with concentrate mixture of undelinted cotton seed cake, maize or guinea corn were offered during the dry season. They had access to water and salt-lick at all times. Regular spraying against ticks was observed while vaccination was carried out against contagious diseases. The cows were milked in the morning and evening daily. While Bunaji calves were allowed to run with their dams until weaning at the age of 6 months, the Friesian-Bunaji calves were separated from their dams and bucket-fed until 3 months of age when they were weaned.

The data consisted of records of 91 Bunaji and 116 Friesian-Bunaji crosses that were milked for more than 305 days. These were subjected to linear and multiple regression analyses using SYSTAT (Wilkinson, 1988) to estimate 305-day yield. Estimation factors for cows lactating for periods between 305 and 350 days were developed. Also, correlations between actual 305-day yield (A305), estimated 305-day yield (E305) and ratio 305-day yield (R305) were computed.

RESULTS AND DISCUSSION

The linear regression of 305-day yield (Y) on total yield (TY) of Bunaji and Friesian-Bunaji cows gave R^2 values of 97.1 and 82.7% respectively. The fitted equations were:

Y (305-day yield) = 185.229 + 0.804TY and

Y (305-day yield) = 366.176 + 0.775TY for Bunaji and Friesian-Bunaji (henceforth referred to as breeds 1 and 2) respectively. It was evident from these R^2 values that when TY alone was used in estimating 305-day yield, it accounted for a large part of the observed variation. There was a difference of 14.4% in the estimating accuracy between the two breeds. This variation among dairy cows of different genetic groups had also been reported by Batra (1986) who developed extension factors for predicting 305-day protein yield in Aryshire, Guernsey, Holstein-Friesian and Jersey cows, and Wiggans (1986) in the projection of protein yield to 305 days in Hosltein-Friesian and Jersey cows.

Various combinations of TY, LL and ADY were used in multiple regressions to estimate 305-day yield and the results are shown in Table 1. Generally, the R^2 values were all above 94% and the earlier observed difference due to breed was reduced from 14.4 to 0.01%. indicates that the accuracy of estimation was considerably increased. It is a fact that the longer a cow remains in milk, the more it yields. This positive correlation between TY and LL was probably responsible for the increment in R^2 values to 98.5 and 97.1% for breeds 1 and 2 respectively. These values were higher than those obtained by Roy and Katpatal (1989) who predicted 300-day milk yield from cumulative monthly milk records.

When the R^2 values of breeds 1 and 2 cows are compared with respect to TY and LL and ADY combinations, there were no significant differences. This seems to imply that whether TY is used in combination with LL or ADY in estimating 305-day yield, the accuracy is not improved. The highest R^2 values of 0.989 and 0.972 were obtained for breeds 1 and 2 when TY, ADY and LL were used in the estimation. Bhutta and Pandey (1989) obtained values that ranged between 0.74 and 0.85.

Total yield (TY) was linearly regressed on lactation length (LL) and the fitted equations were·

TY = -1666.877 + 8.913 LL (R^2 = 0.434) and

TY = 591.373 + 5.546 LL (R^2 = 0.173) for breeds 1 and 2 respectively. Polynomial

TABLE 1: MULTIPLE REGRESSIONS OF 305-DAY YIELD ON TOTAL YIELD (TY), LACTATION LENGTH (LL) AND AVERAGE DAILY YIELD (ADY).

		Regression Coefficients			
Bread*	Intercept	b1	b2	b3	R^2
1	658.486	0.888(TY)	-1.716(LL)	-	0.985
2	1638.722	0.923(TY)	-4.716(LL)	-	0.971
1	40.870	0.514(TY)	137.127(ADY)	-	0.988
2	-163.111	0.3389(TY)	226.090(ADY)	-	0.956
1	-183.074	0.391(TY)	180.240(ADY)	0.647(LL)	0.989
2	1315.905	0.812(TY)	44.607(ADY)	3.933(LL)	0.972

*Bread 1 represents Bunaji
Bread 2 represents Friesian-Bunaji

TABLE 2: MULTIPLICATIVE FACTORS FOR ESTIMATING 305-DAY YIELD

Lactation Length	Bunaji	Friesian x Bunaji	Lactation Length	Bunaji	Friesian x Bunaji
305	1.000	1.000	328	0.837	0.947
306	0.991	0.997	329	0.831	0.945
307	0.983	0.995	330	0.825	0.943
308	0.975	0.993	331	0.819	0.941
309	0.967	0.990	332	0.814	0.938
310	0.959	0.988	333	0.808	0.936
311	0.952	0.986	334	0.803	0.934
312	0.944	0.983	335	0.797	0.932
313	0.936	0.983	336	0.792	0.930
314	0.929	0.979	337	0.787	0.928
315	0.922	0.976	338	0.781	0.926
316	0.915	0.974	339	0.776	0.924
317	0.908	0.972	340	0.771	0.922
318	0.901	0.969	341	0.766	0.919
319	0.894	0.967	342	0.761	0.917
320	0.887	0.965	343	0.756	0.915
321	0.881	0.963	344	0.752	0.913
322	0.874	0.960	345	0.747	0.911
323	0.868	0.958	346	0.742	0.909
324	0.861	0.956	347	0.737	0.907
325	0.855	0.954	348	0.733	0.905
326	0.849	0.951	349	0.728	0.903
327	0.843	0.949	350	0.724	0.901

regressions were fitted but without much improvement. The low R^2 values indicates that lactation length alone is not sufficient to estimate total yield of cows. This becomes more obvious since the cows would have been in the declining phase of the lactation curve long before 305 days in milk. This could probably account for the low correlation between TY and LL at this stage and the subsequently low R^2 values. There was also a marked breed difference observed for the fitted regressions.

Table 2 shows the multiplicative factors for estimating 305-day yield. For breed 1 cows, they range from 0.724 to 1.000. The range for breed 2 cows is 0.901 to 1.000. Since breed 2 cows yield more milk than those of breed 1, this difference is clearly reflected in the magnitude of the multiplicative factors.

The phenotypic correlations between the actual, ratio and estimated 305-day yields for the two breeds are shown in Table 3. These were generally positive and highly significant ($P<0.001$) with no marked breed differences.

TABLE 3: CORRELATIONS BETWEEN ACTUAL (A305), RATIO(R305) AND ESTIMATED (E305) 305-DAY YIELDS FOR BUNAJI (ABOVE DIAGONAL) AND FRIESIAN-BUNAJI (BELOW DIAGONAL)

Variables	A305	R305	E305
A305		0.997	0.970
R305	0.990		0.982
E305	0.994	0.999	

The correlations of 0.97 and 0.99 between the estimated and actual 305-day yields in breeds 1 and 2 agree with the range of 0.87 to 0.99 reported by Wilmink (1986), but higher than the 0.84 to 0.86 range reported by Roy and Katpatal (1989).

The results of this study indicate that using the TY of Bunaji and Friesian-Bunaji cows lactating for over 305 days to estimate 305-day yield accounted for 97 and 83% of the observed variation. Where information on TY, LL and ADY is available, this accuracy of estimation is increased. Also, the use of multiplicative factors developed for estimating 305-day yield give LL information, is very reliable since positive correlations of 0.97 and 0.99 between the actual and estimated 305-day yields in the two breeds were obtained.

In conclusion, it is recommended that as much as possible, recording schemes in dairy herds should endeavour to record the actual 305-day yield of cows in addition to their total yields.

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